

**Hillsborough Township School District**  
**Hillsborough High School**  
**Applied Technology Curriculum**  
**Mechanical Drawing 1 (Semester Course)**  
**August, 2012**

## ELEMENTS OF CURRICULUM

Course Overview  
Curriculum Outlined  
Standards for Technological Literacy

## Course Overview

In Mechanical Drawing 1, students will learn to create and interpret engineering drawings. Through use of traditional drafting methods, the students learn the rudiments of mechanical drawing. Later in this semester course, students experience drafting with computer assistance. Projects are designed to provide learning experiences in sketching, geometric construction, orthographic projection and isometric drawing, among other conventional drafting concepts.

| Unit  | Pacing # of Weeks  | Essential Questions  | Enduring Understandings   | Content   | Skills  | Assessment   | NJCCCS CPI   | Common Core Literacy   |
|---|--|--|---|---|---|--|--|--|
| <b>Rationale, Purpose and Use of Technical Drawing</b><br><b>Unit 1</b> | <b>Standard Level:</b><br>1 to 2 days<br>18 weeks<br>Embedded, discussed, introduced, integrated, and reviewed throughout all units during the semester. | Why is drafting called a universal language?<br>Describe the “language of industry.”<br>What are the two forms drawings can be made? | Drafting can be explained to any person with the use of specialty views and sketches. | Mechanical Drawing: is a universal language made up of lines as forms of alphabets, words and sentences.<br>The use of Technical Drawing in the manufacturing industry:<br>Characteristics of working drawings. | Define the following terms:<br><ul style="list-style-type: none"> <li>• Diagram</li> <li>• Drafting</li> <li>• Symbols</li> </ul> Discuss the importance and uses of manuals, buildings, drawings, working drawings and circuit diagrams with students.<br>Discuss the ideas of designing to solve problems with students.<br>Describe the technological changes in the ways drawings are made and stored<br>Cite why drafting is called a universal language | Teacher observation of student<br>Student completing teacher assigned evaluation with rubric<br>Successful Completion of safety test and assignments<br>Teacher questioning of student | 9.4.12.O.4<br>Select and employ appropriate reading and communication strategies to learn and use technical concepts and vocabulary in practice.<br>9.4.12.O.1.11<br>Demonstrate understanding of processes and concepts that are key to understanding the design process.<br>9.4.12.O.1.12<br>Model technical competence by developing and applying processes and concepts in the design process. | RH 9-12.4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone. |
|   |  |  |   |   |   |  |  |  |

| Unit             | Pacing # of Weeks | Essential Questions  | Enduring Understandings   | Content   | Skills   | Assessment  | NJCCCS CPI  | Common Core Literacy   |
|------------------|-------------------|--|---|---|--|---|---|--|
| Unit 2           | 2 to 4 days       | What are the Alphabet of Lines?  | Lines in technical drawings are part of a specialized graphic language that is standardized throughout industry. Each type of line has a very precise symbolic meaning. | Demonstrate sketching skills and techniques.  | Define the following terms:  | Teacher observation of student  | 9.4.12.O.1.11   | RH 9-12.9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take. |
|                  | 18 weeks          | Where does a sketch derive from?<br>Why are hidden lines used?<br>Why are extension lines used?<br>How are construction lines and guide lines similar? | Correct usage of this "alphabet of lines" is essential whether you use traditional drafting methods or CAD.   | Apply the alphabet of lines to a drawing.<br>Sketch basic geometric shapes.<br>Enlarge or reduce the drawn size of an object by the graph method. | <ul style="list-style-type: none"> <li>• Accuracy</li> <li>• Alphabet of Lines</li> <li>• Arc</li> <li>• Axis</li> <li>• Border Line</li> <li>• Centerline</li> <li>• Conical</li> <li>• Construction Line</li> <li>• Coordinates</li> <li>• Cutting</li> <li>• Plane Line</li> <li>• Diagonal</li> <li>• Dimension Line</li> <li>• Dimensions</li> <li>• Hexagon</li> <li>• Object Line</li> <li>• Sketching</li> </ul> | <p>9.4.12.O.(1).2 Apply and use algebraic, geometric, and trigonometric relationships, characteristics, and properties to solve problems.</p> <p>9.4.12.O.(1).9 Employ concepts and processes for the application of technology to engineering.</p> | <p>WHST 9-12.6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.</p> |  |
| <b>Sketching</b> |                   |  |   |   |  |   |   |  |

Benchmarks for standards for technological literacy: 8, 9 10, 11, 17

| Unit                                    | Pacing # of Weeks | Essential Questions  | Enduring Understandings   | Content   | Skills  | Assessment   | NJCCCS CPI   | Common Core Literacy   |
|---|-------------------|--|---|---|---|--|--|--|
| <b>Standard Level:</b><br><b>Unit 3</b> | 3 to 5 days       | How is a T-square properly used?   | Applying drafting tools and equipment allows students to read and measure with a variety of drafting scales, develop production quality line work that can be reproduced. | Identify basic drafting equipment.<br>Use drafting equipment in a safe and efficient manner.<br>Explain the terms CAD and CADD.<br>Explain why the principles of drafting are common to both traditional drafting and CAD.<br>Apply care and maintenance to the drafting materials and equipment. | Display the various drawing equipment and materials for students to learn their names and discuss their uses.<br>Demonstrate the correct use of each drawing equipment and materials and let students practice with them. | Teacher observation of student<br>Student completing teacher assigned evaluation with rubric | 9.4.12.O.1.1.11<br>Demonstrate understanding of processes and concepts that are key to understanding the design process.<br>9.4.12.O.1.1.2<br>Model technical competence by developing and applying processes and concepts in the design process.<br>9.4.12.O.(1).2<br>Apply and use algebraic, geometric, and trigonometric relationships, characteristics, and properties to solve problems. | RH 9-12.9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.<br>WHST 9-12.6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. |
|   | 18 weeks          | How are 75 and 15 angles created?<br>What tool is used to draw circles and arcs?<br>What tool is used to subdivide distances and transfer measurements?<br>Why are erasing shields applied?<br>Scales are used for accurate measurements.<br>What are the four types of scales used for this course? |   |   |   |  |  |  |
| <b>Drafting Equipment and Materials</b> |                   |  |   |   |   |  |  |  |

Benchmarks for standards for technological literacy: 8, 9, 10, 11, 17

| Unit   | Pacing # of Weeks | Essential Questions   | Enduring Understandings   | Content  | Skills  | Assessment  | NJCCCS CPI  | Common Core Literacy  |
|--|-------------------|---|---|--|---|---|---|---|
| Unit 4<br>Standard Level:<br>Semester Elective | 18 weeks          | <p>What are the twelve basic geometric shapes used in this course?</p> <p>How do you bisect an angle, arc, and line?</p> <p>How do you construct a triangle from given line lengths?</p> <p>How do you construct an equilateral triangle?</p> | <p>Construct a variety of geometric shapes using proper construction methods.</p> | <p>Identify basic geometric shapes.</p> <p>Bisect a line, arc, and angle.</p> <p>Transfer an angle and construct an equilateral triangle.</p> <p>Draw a square with a side given.</p> <p>Construct a pentagon, a hexagon, and an octagon.</p> <p>Draw an arc tangent to two lines.</p> <p>Draw an arc tangent with a straight line and a given arc and draw tangent arcs.</p> <p>Divide a line into a given number of equal divisions.</p> <p>Construct an ellipse by several methods.</p> | <p>Define the following terms:</p> <ul style="list-style-type: none"> <li>• Arc</li> <li>• Axis</li> <li>• Bisect</li> <li>• Circle</li> <li>• Circumscribe</li> <li>• Centric</li> <li>• Diagonal</li> <li>• Geometric</li> <li>• Diameter</li> <li>• Quadrant</li> <li>• Radius</li> </ul> <p>Discuss basic geometric shapes and demonstrate several drawing methods to complete given objects.</p> | <p>Teacher observation of student</p> <p>Student completing teacher assigned evaluation with rubric</p> <p>Successful completion of projects and assignments with terminology and content</p> <p>Teacher questioning of student</p> | <p>9.4.12.O.1.11<br/>Demonstrate understanding of processes and concepts that are key to understanding the design process.</p> <p>9.4.12.O.1.12<br/>Model technical competence by developing and applying processes and concepts in the design process.</p> <p>9.4.12.O.(1).2<br/>Apply and use algebraic, geometric, and trigonometric relationships, characteristics, and properties to solve problems.</p> <p>9.4.12.O.(1).9<br/>Employ concepts and processes for the application of technology to engineering.</p> | <p>RH 9-12.9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.</p> <p>WHST 9-12.6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.</p> |
|  |                   |   |   |  |   |   |   |   |

**Basic Geometric Construction**

Benchmarks for standards for technological literacy: 8, 9 10, 11, 17

| Unit   | Pacing # of Weeks | Essential Questions  | Enduring Understandings   | Content  | Skills   | Assessment   | NJCCCS CPI   | Common Core Literacy   |
|--|-------------------|--|---|--|--|--|--|--|
| Unit 5<br>Types of Lines, Lettering, and Numbers | 2 to 4 days       | Why must lettering on a drawing be neat and legible?   | Standard lettering for Mechanical Drawing is called gothic lettering. All the letters are capitalized and squared. This style lettering promotes good legible penmanship. | Definitions and types of lines (outline, construction line, dimension line, center line, hidden line, cutting plane and broken lines)<br><br>Lines and their applications or uses.<br><br>Drawing Types of lines.<br><br>Perpendicular and parallel lines.<br><br>Construction of perpendicular and parallel lines.<br><br>Upper and lower case letters.<br><br>Writing of numbers 0 to 9. | Illustrate and discuss the features of types of lines with students.<br><br>Assist students to draw different types of lines.<br><br>Discuss various applications of each type of line with students.<br><br>Illustrate the appropriate techniques of drawing types of lines and let students practice.<br><br>Illustrate how to draw parallel and perpendicular lines correctly without using drawing instruments and let students practice<br><br>Illustrate how to construct parallel and perpendicular lines with students and let them practice | Teacher observation of student<br><br>Student completing teacher assigned evaluation with rubric<br><br>Successful completion of projects and assignments with terminology and content<br><br>Teacher questioning of student | 9.4.12.O.1.11 Demonstrate understanding of processes and concepts that are key to understanding the design process.<br><br>9.4.12.O.1.12 Model technical competence by developing and applying processes and concepts in the design process.<br><br>9.4.12.O.(1).2 Apply and use algebraic, geometric, and trigonometric relationships, characteristics, and properties to solve problems. | RH 9-12.9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.<br><br>WHST 9-12.6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. |
|  | 18 weeks          | Why does the industry use mechanical lettering devices?<br><br>Why should guide lines be used when lettering?<br><br>Name three types of lettering aids and mechanical lettering devices. Briefly describe how each works. |   |  |  |  |  |  |

Benchmarks for standards for technological literacy: 8, 9 10, 11, 17



| Unit   | Pacing # of Weeks   | Essential Questions  | Enduring Understandings  | Content  | Skills   | Assessment   | NJCCCS CPI  | Common Core Literacy   |
|--|---|--|--|--|--|--|---|--|
| Unit 6<br>Standard Level:<br>Semester Elective | 4 to 6 days   | What is an orthographic drawing?   | An orthographic view is a method of showing a three dimensional object in two dimensions by showing the front, top, and side views. Each view is evenly aligned with each other. | Explain orthographic projection (single plane and multiple plane).<br><br>Distinguish between first and third angle projections.   | Assist students to explain orthographic projections (single plane and multiple plane).<br><br>Demonstrate the projection method.   | Teacher observation of student<br><br>Student completing teacher assigned evaluation with rubric                     | 9.4.12.O.1.11<br>Demonstrate understanding of processes and concepts that are key to understanding the design process.  | RH 9-12.9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take. |
|  | 18 weeks<br><br>Embedded, discussed, introduced, integrated, and reviewed throughout all units during the semester. | In developing the needed views, the object being drawn is normally viewed from six directions.<br>What are the six views that will be seen?<br><br>Describe the "projection method." |  | Identify the views necessary to make a multiview drawing.<br><br>Locate orthographic drawings on the drawing sheet.<br><br>Transfer points between views when making multiview drawings. | Guide students to show the appropriate symbols for each projection.<br><br>Guide students to practice orthographic drawings using selected objects.<br>NOTE:<br>Emphasize neat work, correct projection, symbols and construction lines. | Successful completion of projects and assignments with terminology and content<br><br>Teacher questioning of student | 9.4.12.O.1.12<br>Model technical competence by developing and applying processes and concepts in the design process.<br><br>9.4.12.O.(1).2<br>Apply and use algebraic, geometric, and trigonometric relationships, characteristics, and properties to solve problems. | WHST 9-12.6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.                     |

**Orthographic Projections**

Benchmarks for standards for technological literacy: 8, 9 10, 11, 17

| Unit                                    | Pacing # of Weeks   | Essential Questions  | Enduring Understandings  | Content   | Skills   | Assessment   | NJCCCS CPI   | Common Core Literacy   |
|---|---|--|--|---|--|--|--|--|
| <b>Dimensioning and Notes</b><br>Unit 7 | 2 - 4 days<br>18 weeks<br>Embedded, discussed, introduced, integrated, and reviewed throughout all units during the semester. | Why are dimensions and notes used in drawings?<br>What is the visible gap for extension lines?<br>What is the difference between unidirectional and aligned dimensions?<br>How are angular dimensions expressed? | The purpose of dimensioning is to provide a clear and complete description of an object.<br>A complete set of dimensions will permit only one interpretation needed to construct the part. | Explain why dimensions and notes are needed on drawings.<br>Describe the difference between unidirectional and aligned dimensioning.<br>Apply the general rules for dimensioning inch and/or metric drawings.<br>Dimension circles, holes, and arcs.<br>Explain the five methods used in the changeover from conventional inch measurements to metric measurements. | Define the following terms:<br>• Aligned<br>• ANSI<br>• Arrowhead<br>• Datum<br>• Degrees<br>• Dimension<br>Assist students to discuss the principles of dimensioning.<br>Using charts assist students to discuss the importance of dimensioning.<br>Using charts, illustrate the application of principles of dimensioning to students. | Teacher observation of student<br>Student completing teacher assigned evaluation with rubric<br>Successful completion of projects and assignments with terminology and content<br>Teacher questioning of student | 9.4.12.O.1.11<br>Demonstrate understanding of processes and concepts that are key to understanding the design process.<br>9.4.12.O.1.12<br>Model technical competence by developing and applying processes and concepts in the design process.<br>9.4.12.O.(1).2<br>Apply and use algebraic, geometric, and trigonometric relationships, characteristics, and properties to solve problems.<br>9.4.12.O.(1).9<br>Employ concepts and processes for the application of technology to engineering. | RH 9-12.9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.<br>WHST 9-12.6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. |

Benchmarks for standards for technological literacy: 8, 9 10, 11, 17

| Unit   | Pacing # of Weeks  | Essential Questions  | Enduring Understandings   | Content   | Skills   | Assessment   | NJCCCS CPI   | Common Core Literacy   |
|--|--|--|---|---|--|--|--|--|
| Unit 8<br><b>Sectional Views and True Shapes of Cut Surfaces</b> | Standard Level:<br>2 - 4 days  | What are sectional views?  | A section view is a drawing used on a area or hidden part of an object by cutting away or removing some of that object. | Describe what a sectional view is and why it is used.   | Define the following terms:<br><ul style="list-style-type: none"> <li>Aligned section</li> <li>Conventional break</li> <li>Cutting plane</li> <li>Full section</li> <li>Half section</li> </ul>  | Teacher observation of student   | 9.4.12.O.1.11<br>Demonstrate understanding of processes and concepts that are key to understanding the design process.   | RH 9-12.9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take. |
|  | 18 weeks<br>Embedded, discussed, introduced, integrated, and reviewed throughout all units during the semester.<br><br>Used as needed per assignment | When are sectional views used?<br><br>When is a cutting plane line needed?<br><br>What is the spacing of general purpose section lining? |   | Draw sectional views when required.<br><br>Apply the following types of sectional views to various drawings: full section, half section, revolved section, aligned section, removed section, and broken out section.<br><br>Explain the rules for hatching the true shape of a cut surface. | Use models and charts to explain the concept and importance of sections.<br><br>Guide students to explain the importance of drawing true shapes of cut surfaces of Objects.<br><br>Use charts and models to explain the true shapes of cut surfaces of solids. | Student completing teacher assigned evaluation with rubric<br><br>Successful completion of projects and assignments with terminology and content<br><br>Teacher questioning of student | 9.4.12.O.(1).2<br>Apply and use algebraic, geometric, and trigonometric relationships, characteristics, and properties to solve problems.<br><br>9.4.12.O.(1).9<br>Employ concepts and processes for the application of technology to engineering. | WHST 9-12.6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.                     |

Benchmarks for standards for technological literacy: 8, 9 10, 11, 17

| Unit  | Pacing # of Weeks   | Essential Questions   | Enduring Understandings  | Content  | Skills  | Assessment   | NJCCCS CPI  | Common Core Literacy   |
|---|---|---|--|--|---|--|---|--|
| <b>Pictorial Drawing: Oblique and Isometric</b><br>Unit 9 | 1 week<br>Utilizes elements and content from previously outlined units. | What is an isometric drawing?<br>What angular degree are isometrics drawn?<br>What is an oblique drawing? | Pictorial projection in which all three dimensions of an object are shown in one view. | Explain isometric drawing and its principles.<br>Use isometric axis to draw given objects.<br>Explain oblique drawing and its principles.<br>Use oblique axis to draw given objects. | Discuss the principles for isometric drawing with students.<br>Illustrate how to apply the principles to draw objects in isometric and let students practice.<br>Using illustrations, explain the principles for oblique drawing with students.<br>Illustrate how to apply the principles to draw objects in oblique and let students practice. | Teacher observation of student<br>Student completing teacher assigned evaluation with rubric<br>Successful completion of projects and assignments with terminology and content<br>Teacher questioning of student | 9.4.12.O.1.11<br>Demonstrate understanding of processes and concepts that are key to understanding the design process.<br>9.4.12.O.1.12<br>Model technical competence by developing and applying processes and concepts in the design process.<br>9.4.12.O.(1).2<br>Apply and use algebraic, geometric, and trigonometric relationships, characteristics, and properties to solve problems. | RH 9-12.9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.<br>WHST 9-12.6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. |
|   |   |   |  |  |   |  | 9.4.12.O.(1).9<br>Employ concepts and processes for the application of technology to engineering.   |  |

Benchmarks for standards for technological literacy: 8, 9 10, 11, 17

| Unit                         | Pacing # of Weeks | Essential Questions  | Enduring Understandings   | Content  | Skills  | Assessment   | NJCCCS CPI   | Common Core Literacy   |
|------------------------------|-------------------|--|---|--|---|--|--|--|
| Unit 10<br>Semester Elective | 1 week            | How do lines, measurements, basic shapes and geometric construction relate to developing mechanical drawings?<br><br>Where is geometry used in the human designed and controlled world?<br><br>Are mathematical formulas invented or discovered?<br><br>How would your lifestyle be impacted without the knowledge of mathematics and mathematical formulas? | Mathematical formulas are applied to basic shapes to assist with mechanical drawings. | Geometric figures and relationships can be represented numerically, graphically and with models.<br>Math and mathematical formulas play a role in other disciplines and in life.<br>Geometry and mathematical formulas are an integral part of graphic representation.<br><br>There are many different types of angles including right, acute, obtuse and complimentary.<br>Various geometric shapes can be drawn using specific tools and equipment or by using mathematical methods. | Draw examples of various triangles, quadrilaterals, circles, arcs and polygons.<br><br>Divide a line into equal parts or proportional parts.<br><br>Draw specific angles using a triangle (tool) or the tangent, sine method.<br><br>Draw various geometric shapes from written descriptors.<br><br>Apply various mathematical formulas in the drawing of geometric shapes. | Teacher observation of student<br><br>Student completing teacher assigned evaluation with rubric<br><br>Successful completion of projects and assignments with terminology and content<br><br>Teacher questioning of student | 9.4.12.O.1.11<br>Demonstrate understanding of processes and concepts that are key to understanding the design process.<br><br>9.4.12.O.1.12<br>Model technical competence by developing and applying processes and concepts in the design process.<br><br>9.4.12.O.(1).2<br>Apply and use algebraic, geometric, and trigonometric relationships, characteristics, and properties to solve problems.<br><br>9.4.12.O.(1).9<br>Employ concepts and processes for the application of technology to engineering. | RH 9-12.9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.<br><br>WHST 9-12.6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. |
|                              |                   |  |   |  |   |  |  |  |

**Geometry and Mathematical Formulas**

Benchmarks for standards for technological literacy: 8, 9 10, 11, 17